THE TREATMENT OF CORONARY DISEASE*

CHARLES C. WOLFERTH

Professor of Clinical Medicine, School of Medicine, University of Pennsylvania

IT WAS with reluctance and misgiving that I accepted the flattering invitation of your Committee to discuss the treatment of coronary disease. We all know that progress in this field, despite much hard work, has been modest and that we have little more than a toe-hold on the problems which beset us. Moreover the therapy of coronary disease has been discussed so frequently that one hesitates to add still another presentation to a literature whose volume is already out of proportion to knowledge of the subject. I could not cover all aspects of the topic assigned me in a presentation of this length. I have no startling new facts to bring to your attention. At most I can share with you certain of my reflections and points of view that have developed in the course of struggling with this problem for many years.

INVESTIGATIVE STANDARDS AND OBJECTIVES

The charge that its investigative work is not on a high plane has frequently been leveled against clinical medicine. The most recent of such criticisms to come to my attention is contained in the following quotation from Sir Thomas Lewis:[1] "Clearly to recognize the limitations of present day knowledge and fully to realize the contrast between medical writings and the closely reasoned argument and precise recording now found in the ancillary sciences, are matters of prime consequence in an approach to the problem of reform in medical education." One need not necessarily be so impressed as is Sir Thomas by the contrast between "medical writings" and those of the "ancillary sciences" but the need for closely reasoned argument and precise recording in all scientific fields can scarcely be challenged. One might add that the closely reasoned argument requires tests of the assumptions upon which

* From the Edward B. Robinette Foundation, Medical Clinic. Hospital of the University of Pennsylvania.
Read January 4, 1945 at the Annual Meeting of The New York Academy of Medicine.

it is based as well as careful checking at every step by precise recording, otherwise, even those working in the ancillary sciences such as the physiologists may stray from the path of truth. I venture to assert that there are many clinical investigators whose work is fully up to the standard of the best produced by their confreres in physiology. On the other hand we have to admit that much of what is published in the clinical journals and books does not stem from that vitally essential combination of closely reasoned argument and precise recording. Too much of the literature dealing with coronary disease is open to this criticism, so much in fact that it constitutes a handicap to those trying to educate themselves and a burden to all who wish to keep abreast of current developments.

Advances in the treatment of coronary disease may result from the discovery of new and more effective procedures or from careful studies which demonstrate more clearly the indications and best methods of use of measures now available. The most urgent needs however are (1) improvement in diagnostic methods so that we can recognize the disease in a far earlier stage than at present and (2) more accurate and complete knowledge of the etiological factors concerned in its production.

The Unsatisfactory Status of Etiology

The difficulties which beset investigation of the causes of coronary disease could scarcely be overestimated. Because in the vast majority of cases it is a manifestation of atherosclerosis, it has been widely assumed that its causes are identical with those of atherosclerosis of other vessels. Such an assumption seems reasonable but it does not take into account possible causes of relatively early and extensive involvement of coronary arteries, as compared with certain other parts of the arterial tree, observed in some individuals. Experimental work seems to show that by certain procedures the coronary arteries can be acutely damaged without material involvement of other arteries.[2] Such results make it seem not unreasonable to entertain the idea that in humans certain etiological factors may produce selectively more atherosclerosis of coronary arteries than of other vessels. Dock[3] has suggested that their relatively thick intima may make these arteries vulnerable.

It seems to be assumed by most writers on the subject of coronary disease that not only is its incidence on the increase but that certain disorders dependent upon it such as angina pectoris and acute coronary

occlusion are increasing even more rapidly. Unfortunately we lack the "precise recording" by which such questions can be settled. Cohn and Lingg[4] in 1934 could not obtain evidence from comparative studies of vital statistics to indicate that coronary disease, taking into account "fashions in diagnosis" and lessened mortality in youth, was much more common than it had been thirty years before. There is no yardstick by which the comparative frequency of angina pectoris and acute coronary occlusion can be measured. One is impelled almost irresistibly to the conclusion that these conditions are more common to-day than they were in the past but evidence to establish that view is lacking. Although most of us knew nothing about acute coronary occlusion thirty years ago, the newspapers of that day featured the sudden death of prominent members of the community just about as frequently as they do now. I still recall the statement of the late Edward Martin made to his class in surgery in 1910 that nearly all of the sudden deaths reported in the newspapers as acute indigestion were in reality due to heart disease.

It would be very helpful if we could settle the question of the relative frequency of coronary disease or any of its manifestations today and in the past. If long familiarity with the assumption that they are increasing and frequent assertion of it make us believe that assumption to be established and we base further work on such a belief without holding it under question, we depart from the scientific method. Acceptance of untested but frequently repeated assumptions is undoubtedly one of the major causes of error in human reasoning. As one examines the upper range of the scale of intellectual sophistication, the traps for the unwary merely become harder to detect. The literature of medicine abounds with them even today. A classical example which does not leave untouched some of our colleagues in the "ancillary sciences" is the history of the Einthoven equilateral triangle hypothesis. This hypothesis constructed by erecting assumption upon assumption without testing most of them, has been used for over thirty years as the starting point for further research leading to voluminous literature. If even one of the important assumptions which underlie the famous hypothesis is shown to be invalid, as I believe it has been, this enormous superstructure falls like a house of cards and thirty years of work along certain lines will have proven a total loss. In view of the many untested assumptions regarding the causes of coronary disease which receive widespread acceptance I believe we are in danger of perpetuating major error in our

thinking and in our work on that subject and above all in our management of patients.

I shall offer only one illustration of the point I have tried to make above and select it because of its bearing on treatment. Many, including myself, believe that certain manifestations of coronary disease such as angina pectoris and acute coronary occlusion are much more common at relatively early ages in heavy smokers than in the general population. One can scarcely fail to be impressed by the large proportion of patients under the age of forty with such disorders who smoke cigars or cigarettes in great excess.[5] It is therefore tempting to conclude that tobacco has been responsible for the coronary disease and its consequences found in these relatively youthful patients. Moreover such a view is supported by other facts. The effect of tobacco in producing vasospasm in peripheral vessels has been demonstrated. Changes in the electrocardiogram can sometimes be produced and occasionally anginal attacks can be precipitated by smoking one or two cigarettes. The frequency of anginal attacks sometimes seems to be lessened if the use of tobacco is stopped. Such an array of evidence seems convincing. On the other hand, there are many heavy smokers who never develop any evidences of coronary disease, probably a far larger group than those who do. There are many other heavy smokers with angina pectoris who are not improved to any perceptible extent by stopping the use of tobacco. Finally one must ask himself to what extent it may be the restlessness, lack of self-discipline or whatever it is that makes some individuals heavy smokers, that is responsible for the coronary disease rather than the tobacco itself. Should we then on the basis of such an unproven case try to stop our patients with coronary disease from smoking? It is asking a lot of a man who is restricted in so many other ways to give up the solace of tobacco. It would seem unwise, however, to advise patients with frequently recurring anginal attacks to continue the use of tobacco without giving abstinence from it a fair trial, whether or not its use accelerates the progress of pathological changes in their arteries. In general it has seemed to me that patients with coronary disease who stop smoking do better than their less coöperative friends but perhaps this is because they follow all their orders better. We still have before us the task of proving that the use of tobacco tends to bring on coronary disease or shortens the life of its victims.

It may be found some day that there is one vital essential link in

the chain of developments leading to the production of atherosclerosis, just as has proved to be the case in the formerly equally mysterious pernicious anemia. In the latter the discovery of effective treatment antedated knowledge of etiology of the disease and actually led to it. However, pending such a happy development in the case of coronary disease we may attempt in so far as it is possible with our limited knowledge to utilize the method of multiple working hypotheses, assuming in each case the probability that a number of factors are operating more or less concurrently.

In view of the frequency of coronary disease and our inability to recognize it until it reaches an advanced stage in at least one or more places in the coronary arterial tree, I think we should assume that any man approaching the age of fifty may have the beginnings of coronary disease, no matter how healthy and vigorous he appears to be. Thus, when a presumably healthy individual of middle age or beyond asks what he can do to keep from getting heart disease, one can at least advise him to be moderate in all things. Obviously if there is a family tendency toward conditions known to accelerate the development of atherosclerosis such as diabetes or hypertension, special emphasis should be placed on examinations for such conditions in order to discover them in an early stage.

Periodic or Health Examinations

The rapidly increasing emphasis on preventive medicine and growing acceptance of periodic or health examinations by industrial organizations and by individuals present an ever greater problem to physicians concerned with the cardiovascular aspects of these examinations. Some papers advocating such examinations overestimate the ability of physicians to detect coronary disease in its early stages and to retard its further development. Too many who have been slapped heartily on the back and told they have no heart disease have died during the next few days or weeks, to the discredit of their optimistic examiners. The most one is justified in saying after a negative examination is that no evidence of heart disease has been found. On the other hand too many are told that they have heart disease on the basis of findings that do not actually establish the fact. In the past such a finding was often an innocent murmur; now it is apt to be some deviation from empirically derived electrocardiographic standards which do not deserve all the faith sometimes

reposed in them. The greatest problem of all concerns the far from small percentage of individuals in older age ranges who present unmistakable evidence of myocardial involvement, in some the result of hypertension but in many others coronary disease without hypertension. Perhaps the greatest single mistake made in the management of these groups is to assume that prognostic data obtained from the study of patients who seek medical advice because of illness apply with equal force to those who are without symptoms. For example bundle branch block in hospital practice has in general an ominous prognosis although there are many exceptions to the rule. On the other hand bundle branch block found in examinations of the presumably healthy has a far more favorable outlook. These individuals as well as others found to have evidence of coronary disease should be instructed to avoid strenuous physical activity, to obtain adequate rest and sleep and avoid indiscretions of food intake and intemperance in other habits. Those whose duties entail severe physical or mental strain should be advised to try to obtain easier work. However, care should be exercised not to place unnecessary restrictions on the lives of these men, and above all not to stop them from useful work if they are able to carry on, and wish to do so. Otherwise one may engender a sense of defeat, mental depression or anxiety. Individuals unnecessarily restricted like those who receive a mistaken diagnosis of heart disease would have been far better off without health examinations.

General Considerations in the Treatment of Patients

The evaluation of treatment in coronary disease is made difficult by the unpredictability of events in any individual case. Studies of the course of the disease have been attempted by many investigators. While the results have not always shown close agreement, they have nevertheless given us figures that enable one to predict with some approach to accuracy, the percentages of complications and the mean expectation of life for large groups of cases. However, to predict what will happen to one patient is sheer guesswork. Everyone familiar with this disease knows that some of the patients desperately ill with acute coronary occlusion not only survive but eventually make a remarkably good recovery and live for many years. Conversely a patient with an apparently mild seizure may die or if he recovers, remain a cardiac cripple as long as he lives. The patient in whom the disease has progressed only to the

point where it can be recognized, may rapidly grow worse or the disease may remain no more than a slight handicap to him for many years. Even those with findings which indicate that coronary disease has gone far enough to produce extensive changes in the myocardium, may have no symptoms whatever and remain active indefinitely.

Even though at present we have no accurate idea as to how much the things we do prolong the lives of our patients with coronary disease or retard the progress of their disease, one need not feel pessimistic about advances along these lines in the future. We have already learned that the problems are not simple and that they cannot be solved by crude investigative methods. Whether or not we discover the vital link or links in the causation of atherosclerosis, there is little doubt that "closely reasoned argument" and "precise recording" can solve some of the problems of treatment. However, in spite of what has been said above, we can do many things to make the lives of our patients more comfortable and useful and we can protect them to some extent at least from unnecessary disabling illness or sacrifice of their lives.

In this day of specialization it is not uncommon to find a patient under treatment by specialists in various fields independently of each other, reminding one of Stephen Leacock's hero who jumped on his horse and rode off in every direction. In group medicine this evil is avoided to some extent at least by a coördinator. In the ordinary practice of medicine it is the general practitioner who should be the coördinator in cases complex enough to require study by others. Patients should be educated to come to him rather than seek out specialists to examine them for what they think is wrong. He is the one who should decide whether special studies are necessary and also to whom the patient should be sent. Treatment unless of a type requiring special skill or equipment or both should be carried out under his direction.

To use an old medical cliché and say that the treatment of coronary disease must be individualized is almost an understatement. This rule applies to almost everything we try to do for these patients. The passion for standardization of all things that can be standardized has led to certain practices in the treatment of coronary disease that can scarcely be defended on rational grounds. One of these is the dictum that every patient who has had an acute coronary seizure should spend four to six weeks at complete bed rest. We owe a debt of gratitude to those who have led the recent revolt against unnecessarily prolonged

bed rest. Not the least of their accomplishments is to help free physicians from bondage to rules, violation of which has made them subject to criticism for any one of the unpredictable events that may occur at any time in patients with advanced coronary disease. No one at this time knows enough about coronary disease to make dogmatic statements about the grade and duration of rest that would prove best for each patient.

The mental and emotional aspects of coronary disease should never be lost sight of in treatment. The publicity accorded this disease and its manifestations in the lay press, the constant emphasis placed on the possibility of sudden death and the fact that almost everyone has personal knowledge of cases in which sudden death or permanent invalidism has occurred, have engendered fear of coronary disease in those who think they may have it that is apt to complicate treatment. All physicians of experience in this field have seen patients incapacitated from fancied heart disease who have recovered as soon as they were actually convinced that they did not have it. We are inclined to pay more attention to the psychiatric state of those who exhibit their neurosis in plain sight. We may however neglect the mental and emotional reactions of those who do not place them on parade but which nevertheless may have a definite bearing on their symptoms.

One of the most interesting aspects of the influence of mental and emotional factors on the symptomatology of coronary disease may be seen in those who hold total and permanent disability insurance policies. Even after seizures that would be classified on the basis of objective evidence as slight, the prognosis for recovery sufficient to enable them to return to work seems to be far worse than in the case of non-policy holders. The physician who helps his already apprehensive patients increase their fears incurs the risk of prolonging incapacity. It is only the incurable optimists who think nothing can happen to them and therefore fail to coöperate in treatment who are benefitted by stimulating respect for their disease.

Advice to a patient as to rest and activities which fails to take into account his psychology because of concentration on the purely physical aspects of the condition may not turn out as well as one anticipates. The physician should be prepared to compromise between the two and make further adjustments depending on the course of events. In general it has seemed to me far better to permit the victims of coronary disease

to carry on useful even though somewhat restricted lives and even permit recreations that do not tax their hearts too much than to have them slowly disintegrate both physically and mentally in an easy chair. I venture this assertion fully cognizant of the fact that occasionally patients subject to angina pectoris may develop an attack on exertion which instead of subsiding, continues with the development of acute coronary occlusion and myocardial infarction.

Inter-Relationships With Other Diseases

The attempt to correlate all of a patient's symptoms under a single diagnosis has long been regarded as sound in principle. It has not, however, so far as I am aware, been sufficiently emphasized that this principle applies with most force to acute illnesses. In diseases as chronic as coronary disease we have to recognize the fact that some of the symptoms of which a patient complains may arise from another of the various disorders to which human flesh is heir. We have also to consider the influence of each of these disorders on the symptoms of the other. I shall mention only a few of these inter-relationships which seem to me important from the viewpoint of treatment although a fairly extensive list might be prepared. The fact that anemia or hyperthyroidism may aggravate or even precipitate the anginal syndrome or heart failure in patients with coronary disease is well known. Under these circumstances the most effective treatment of the cardiac symptoms is control of the anemia or hyperthyroidism. Pains referred along the brachial plexus or intercostal nerves from non-cardiac causes in cases with coronary disease with or without the anginal syndrome, are apt to cause mental anguish to a patient. If he knows he has heart disease it is difficult to convince him that most of the pains around his heart and down his left arm are not caused by his heart disease. The interrelations of symptoms of gall bladder disease and heart disease are often difficult and sometimes impossible to unravel completely. It may be a nice question to decide whether the gall bladder should be removed. In my experience the anginal syndrome has been relieved in only a relatively small percentage of patients with co-existing gall bladder disease. Thus, in considering operation one must give weight to the added risk because of heart disease and should not have too much confidence that the cardiac symptoms will be improved, although symptoms due to digestive tract disturbance which may simulate anginal pain may be completely relieved.

Perhaps the most confusing of all situations arises when painful esophageal spasm occurs in patients who are also subject to the anginal syndrome because the location and type of distress in the two conditions may be similar. Such a case was reported by Edeiken[6] and we have seen several since that time. Misinterpretation of painful episodes of esophageal spasm as manifestations of coronary disease may intensify the agitation at least partly responsible for their production and make treatment futile.

Emphasis on the principles of treatment of coronary disease discussed above is tantamount to an admission that more direct methods of attacking it are limited in their effectiveness. If we learned how to reverse or even to check the atherosclerotic process, methods of doing so would become the most important thing to talk about.

Diet

Many workers feel that atherosclerosis is essentially the result of a metabolic fault and some go so far as to point to cholesterol as the cause of the trouble, particularly the excessive intake of cholesterol of animal origin. Data obtained from animal experiments and an array of clinical observations can be used to support this view. If or when convincing evidence can be presented that low intake of animal cholesterol prevents the occurrence of coronary atherosclerosis or retards its further development, I believe we will be able to convince some of our patients to eat foods with low animal cholesterol content. We would not even have to bother much about women unless they were already hypertensive or diabetic because of the relative immunity of the remainder to coronary disease. It should be a far easier matter to obtain the coöperation of patients in limiting cholesterol intake than in the painful process of reducing their caloric intake enough to lose weight. It would therefore be difficult to overestimate the importance of proving just what part cholesterol or anything else we ingest plays in the development of atherosclerosis. Everyone who has had experience in necropsy work in China agrees that atherosclerosis is rarely found in the aortas or coronary arteries of the Chinese. It might eventually save thousands of American lives every year, including members of the armed forces if lend lease funds could be allocated to feed enough Chinese over a long enough period of time, diets high in animal cholesterol content such as many Americans use from choice in order to find out

whether their metabolism is superior to ours or whether they are merely more sensible about what they eat. Possibly also careful studies during the next few years in Europe on those whose intake of animal cholesterol has been low almost from the beginning of the present war will yield information of value. It would be most instructive to find out whether those who emphasize the value of such foods as milk, butter and eggs to growing children are laying the foundations for coronary atherosclerosis and are thus unwittingly responsible for premature death in the future of up to 25 per cent of the children whose parents are persuaded to use the diets recommended. If coronary disease is actually more common in the United States than it was a few generations ago it is by no means improbable that changes in diet are at least to some extent at fault, and perhaps not those changes which are most criticized. We must have these questions answered: (1) Is coronary disease caused by a fault in metabolism? (2) Is it caused by excessive intake of cholesterol? (3) Is it caused by a combination of the two factors operating in the same individual? (4) Are none of the above concerned in its production? In formulating diets for patients with the idea of preventing coronary disease, without the answers to these questions we are in the same position as those who solemnly tell us what is good for us to eat. I do not mean to imply that we have not learned much about the use of diet in the treatment of certain diseases nor that the knowledge gained has not been of great value. However, the time has come when we must lift our sights and be concerned with the more remote and therefore less easily discovered effects of special diets. We have already had a good lesson on this subject when it was discovered that the high fat diet for diabetics in pre-insulin days, although it seemed to help the diabetic state at the time, was followed by a much greater incidence of premature atherosclerosis than we now encounter in diabetics. However we do not know what a high fat diet will do to the arteries of non-diabetics.

Physicians have to give advice regarding diet to nearly every patient with coronary disease. If they should be so remiss as to forget it, the patients or their families will almost certainly inquire about it. We all know that these individuals should not overload their stomachs, select foods calculated to test the limits of their digestive capacity, eat a large meal just before going to bed, or starting a golf game, or try to drink all the fluids they can hold because health columnists have said this is a

good thing to do. A marked dietary indiscretion or gastro-intestinal upset may precipitate an attack of acute coronary occlusion in those in whom the stage is set for such a calamity. That the gastro-intestinal tract is liable to become the temperamental prima donna of coronary disease in its more advanced stages is only too well known to everyone who has to treat some of its victims. I have no better explanation for this than anyone else who has discussed it, no new suggestions for diverting patients from concentration on their gastro-intestinal tracts and no additions to propose to the present list of relatively ineffective remedies. It has seemed to me that after other causes of digestive disturbances have been ruled out as completely as possible, psychotherapy with attempts to convince the patient that there is no actual disease of the digestive tract and that his indigestion is the result of disturbance in nervous conrol of that tract may sometimes help more than medication. These patients by abstaining from one food after another in the effort to obtain relief may bring on themselves deficiency states which may actually aggravate their digestive disturbances.

Life insurance statistics have made it clear that obesity after youth carries the penalty of decreased expectation of life. It is not clear, however, whether this is the result of obesity per se or other effects of a possible metabolic fault responsible for obesity despite the fact that those constitutionally slender are apt to regard all obesity as exogenous. There can be little doubt that some of the obese feel better after diet and loss of weight. They are less breathless, gastro-intestnal symptoms may improve and even anginal pains, if they are subject to this disorder, are less easily evoked. Others, however, feel weak and unhappy when placed on a diet. It is not unusual to obtain a history from patients who have been persuaded to lose a lot of weight merely because they were too fat, that loss of weight marked the beginning of illness. Some excessively obese cardiac patients rapidly deteriorate and die of heart failure when placed on drastic reducing diets. Moreover, the frequency of acute coronary occlusion during or shortly after marked loss of weight is such as to raise a question whether this is purely coincidence. While slow weight reduction is doubtless highly beneficial in many, one should probably not try to make all have figures like debutantes.

Medicinal Treatment

Most patients when they visit a physician hope that he will be able

to give them medicine to cure their ills or at least relieve their symptoms. Even though we have not as yet discovered any medicines that will cure coronary disease much can often be accomplished for the relief of symptoms. Moreover, medicinal treatment may be helpful in keeping patients alive following acute coronary occlusion and for the treatment of threatened or actual heart failure. These matters have been discussed at considerable length in textbooks and special articles and I propose to make only a few brief comments upon the practical application of certain forms of treatment.

It would be difficult to find a remedy more effective and less harmful than the nitrites for the relief of an attack of angina pectoris. Nevertheless many patients hesitate to use them except for a severe attack and consequently employ the medication only after the attack has reached its height. It is therefore well to instruct them in detail regarding the use of nitrites and make clear the fact that these remedies are not habit forming, that tolerance increases only slightly and does not persist, and that the drug is more effective if used early in a seizure. On the other hand, many patients who are given nitroglycerin for pains in the chest continue to use it believing it to be helpful when in fact it is not. Its effectiveness can be determined by ascertaining the time relation between placing a rapidly soluble tablet under the tongue and the beginning of relief. If this interval exceeds two or three minutes it is extremely unlikely that the nitroglycerin has anything to do with relief of distress, thus immediately bringing the diagnosis under question. There still seems to be some difference of opinion regarding the relative merits of amyl nitrite and nitroglycerin. The former acts more quickly but its effects are so transient that pain is more likely to recur in a few minutes. Although the dosage is more difficult to control, intelligent patients may become expert in its use, being able to inhale enough to relieve pain and still avoid unpleasant nitrite effects. Many patients prefer nitroglycerin because it can be used without attracting attention. Moreover if it is employed at the very beginning of an attack, it usually acts rapidly enough to prevent severe distress.

One of the questions often asked when a patient's treatment is under discussion is whether orally administered theophylline compounds or papaverine will prove useful. I know of no method by which one can predict their results in any given case. It seems unwise to continue using such remedies over long periods of time without trying to find out

whether they are really beneficial. One can usually obtain evidence on this point in reasonably intelligent patients by alternate periods of administration and withdrawal of the drug under consideration without making other changes in treatment at the same time. There seems little doubt that some patients are helped by such remedies and others not at all. Gastric irritation produced by theophylline or theobromine compounds, although apparently well known by everyone, may be frequently overlooked in practice because symptoms produced by the drug are attributed to the disease. One sometimes obtains greatest success in relieving symptoms merely by withdrawing such medicines.

The indications for the use of digitalis in the treatment of coronary disease are to some extent still a matter of controversy. Coronary disease unless life is terminated by one of the accidents that may occur during acute coronary occlusion such as ventricular fibrillation, rupture of an infarct or embolism, tends to progress slowly or rapidly toward left ventricular failure and its consequences. Experience seems to indicate that digitalis rarely benefits patients with angina pectoris and frequently aggravates this condition. It has some value in helping to prevent attacks of paroxysmal cardiac dyspnea. It is most useful in cases with chronic or established auricular fibrillation to help keep the ventricular rate under control. It is also useful in congestive failure. Digitalis is often administered to patients in advanced stages of coronary disease when rapid deterioration or sudden death are to be looked for. Nevertheless, the frequency of such occurrences at just about the time digitalis effects are obtained suggests that this drug is not without danger and if used even for the more chronic manifestations should be administered cautiously. Experimental studies seem to show that full digitalis dosage increases the mortality of animals with acute coronary obstruction. One may question whether it has any use in human acute coronary occlusion aside from the control of the ventricular rate in such abnormal mechanisms as auricular fibrillation, when there is reason to believe that the rapid rate is contributing to a dangerous grade of heart failure.

In the treatment of acute coronary occlusion the stakes are always death versus an unpredictable grade and duration of recovery. In an illness in which death may occur suddenly without forewarning or the patient who seems almost moribund may recover, one must be cautious in drawing conclusions as to the results of treatment. In deciding on a step in treatment one should give full weight to its dangers as well as

its possible advantages. I have already referred to the possible danger of digitalis. Perhaps no one would deny the value of morphin or drugs with similar actions to relieve pain or restlessness but the last dose which relieves pain completely may produce depression of respiration and perhaps be responsible for the death of the patient. The intravenous injection of theophylline ethylenediamine is often followed promptly by a marked improvement of a profoundly depressed circulation thus averting what had seemed to be almost imminent death. On the other hand, too many patients die within a few minutes after such an injection even though it be given over a period of five to ten minutes, for the death to be always a coincidence. This danger I believe can be almost completely averted by administration of 0.5 gm. of theophylline ethylenediamine diluted with 200 cc. of salt or glucose solution by slow intravenous drip over a period of two hours. It can be repeated several times a day when necessary to sustain the circulation.

The value of oxygen, efficiently administered in high concentration in patients critically ill with acute coronary occlusion is beyond question. However, its use should not be postponed until the patient is critically ill. It often has great value in relieving pain, as can be demonstrated by stopping it temporarily, thus reducing the need for morphin. Moreover it may produce definite improvement in the circulation. Thus, there are reasons for believing that when given promptly it may prevent critical illness or death. The mode of administration is important. Nasal catheters and the masks in popular use are liable to annoy the patient and increase restlessness. A small transparent plastic hood covering only the head and upper chest, such as the one devised by Lambertsen and Godfrey,[7] having the shape of an egg bisected longitudinally and attached to the ordinary air conditioning unit is highly efficient and much more satisfactory from the point of view of the patient and nurse as well as the physician, than any other apparatus I have used including large oxygen tents. Oxygen concentrations of 60 to 88 per cent can be maintained by an oxygen flow of 6 to 10 liters per minute. When the small hood is used, it must be kept under observation in desperately ill patients because of the undesirable concentration of carbon dioxide if the motor stops. It should therefore be removed when the nurse is to leave the room for any length of time.

Surgical Procedures

The idea that some of the problems of circulatory disease can be

attacked by rendering ineffective certain functions of those parts of the nervous system which have to do with the heart and blood vessels although not new, is attracting more and more attention. Procedures designed to block pain impulses have a limited although worthy objective which is to make the patient more comfortable. Among such is the paravertebral alcohol injection procedure developed by Swetlow[8] on the basis of Mandl's observation that angina pectoris can be relieved temporarily by the injection of procain into the same areas and J. C. White's[9] operation of resection of sympathetic dorsal nerve root connections. That these procedures are capable of relieving anginal pains seems to have been established beyond question by competent observers. Personally I have had no experience with White's procedure and little with paravertebral alcohol injection because of the rarity in my experience of cases in which such measures seem necessary for the relief of anginal pain. After one has eliminated hiatus hernia, the varieties of spasm of the gastro-intestinal tract which may accompany gall bladder disease or nervous states, and the various somatic causes of pain in the distribution of the brachial plexus and intercostal nerves in patients who may or may not also have the anginal syndrome, there remain only a few in which nerve block for the relief of the anginal pain itself has seemed to me necessary or even desirable. However, I do not mean to imply that when severe pain, whatever its origin, cannot be relieved by simpler measures, relief should not be sought by nerve block.

It is entirely possible that the extensive sympathectomies now being employed for the treatment of hypertension may retard the development of coronary atherosclerosis in the patients operated on successfully by virtue of a lower blood pressure resulting from the operation. If this proves to be the case, the operation will prolong the lives of those who would otherwise have died as a result of coronary complications of their disease.

The success of sympathectomy in the treatment of peripheral vascular disease seems to depend in large measure on the extent to which vasospasm contributes to the deficiency of blood supply and its relief by operation. Moreover there is now some evidence to indicate that the development of collateral circulation is encouraged by a state of dilatation of vessels already in the neighborhood.[10] If these statements apply to the heart as well as the legs, one of our objectives should be the development of an operation which will produce maximum vasodilatation

of the coronaries and another should be the development of procedures by which the grade of coronary vasospasm can be recognized so that the operation could be applied to suitable cases. By such means it is at least theoretically possible that some of the evil effects of coronary disease could be mitigated.

The Evaluation of New Forms of Treatment

During the course of this discussion, I have repeatedly emphasized the gaps in our knowledge of coronary disease and the limitations of the modes of treatment at our disposal. For such reasons, medicine should be especially careful not to rest on its modest laurels in this field but be eager for new ideas and receptive to new proposals for treatment. However, we have the right to demand that they be based on the closely reasoned argument and precise recording that Sir Thomas Lewis[1] properly insists should characterize medical writings. The criteria upon which the value of a remedy should be based must include sufficient experience with it so that its possible disadvantages or dangers are recognized, accurate diagnosis so that one knows what he is treating and enough precisely recorded data so that the fallacy of post hoc, ergo propter hoc can be excluded. Without such requirements, we shall doubtless continue to have new forms of treatment recommended without adequate study, received by the uncritical with a wave of enthusiasm and then dropped when their lack of value is finally established. With insistence on scientific standards, we shall undoubtedly work our way forward, even though it be at times a slow and tedious process.

REFERENCES

1. Lewis, T. Reflections upon reform in medical education, present state and needs, *Lancet,* 1944, *1*:619.
2. Klinge, F. Die Eiweissüberempfindlichkeit (Gewebsanaphylaxie) der Gelenke, *Beitr., z. path. Anat. u. z. allg. Path.,* 1929, *83*:185.
3. Dock, G., Jr. Address to the Philadelphia Pathological Society, Dec. 14, 1944.
4. Cohn, A. E. and Lingg, C. Heart disease from the point of view of the public health, *Am. Heart J.,* 1934, *9*:283.
5. White, P. D. Coronary disease and coronary thrombosis in youth, *J. M. Soc. New Jersey,* 1935, *32*:596.
6. Edeiken, J. Angina pectoris and spasm of cardia with pain of anginal distribution on swallowing, *J.A.M.A.,* 1939, *112*:2273.
7. Lambertsen, C. J. and Godfrey, L. Small efficient hood for oxygen therapy, *J.A.M.A.,* 1944, *125*:492.
8. Swetlow, G. I. Paravertebral alcohol block in cardiac pain, *Am. Heart J.,* 1925-26, *1*:393.
9. White, J. C. and Smithwick, R. H. *The autonomic nervous system.* 2. ed. New York, Macmillan, 1941.
10. Naide, M. *Personal communication.*